Format®

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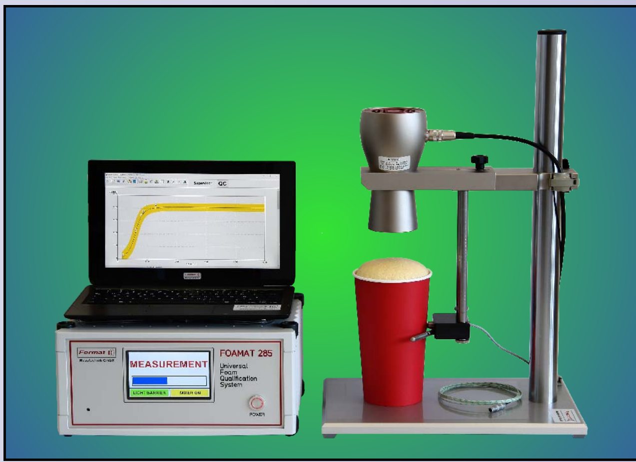
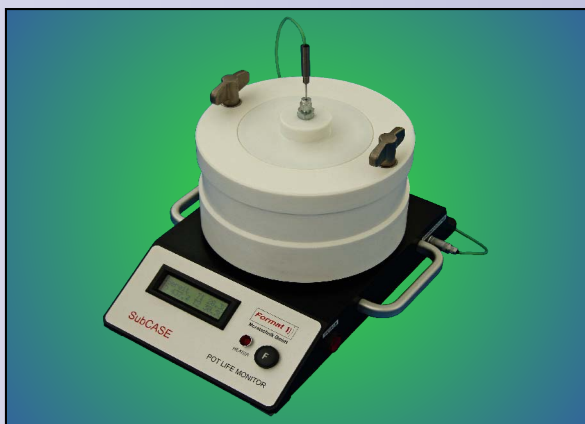
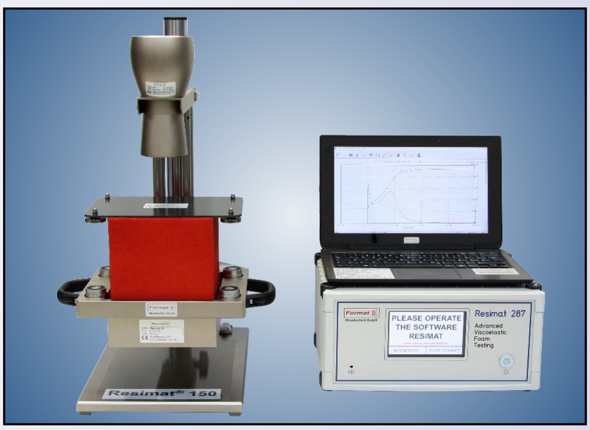


Foam Qualification System
FOAMAT® 285



Pot Life and Curing Monitor
SubCASE®

Format Testing Equipment



Viscoelastic Foam Testing
Resimat®

Thickness Measurement
Sonic Joker®

Format
Messtechnik GmbH

FOAMAT®

FOAMAT® 285

Universal Foam Qualification System

Figure 1: *The Universal Foam Qualification System **FOAMAT 285** is supplied with different test containers. The base system consists of the stand, the ultrasonic fan sensor **LR 4**, the controller unit, and the PC software **FOAM**. The Advanced Test Containers **ATC** and **ATC XL** (left) are the most sophisticated test containers. The innovative Box Foam Container **BFC 200** is used for slabstock foam. The Foam Pressure Measurement devices **FPM 2, FPM 70** and **FPM 150** (right) use disposable cardboard cylinders of different diameters. Disposable cups can also be used. Patent Nos. 3621819, 19730891 and 10044952*

Formation Parameters

The quality of polyurethane foam (PU), polyisocyanurate foam (PIR), phenolic, silicone and epoxy foam depends on the conditions during their formation. Therefore, it is important to take representative samples regularly and to record their formation parameters. Consistent product quality is ensured by measuring the formation parameters during the foaming process. The measured curves are compared to specified standards in the form of master curves. Many automotive system suppliers apply this method to vehicle-interior parts and modules. The furniture industry, along with the construction and equipment insulation industry, also measure formation parameters for quality assurance purpose. When foam parts with special properties are being developed, measuring the foam formation parameters gives an insight into how the reaction is proceeding and how foam formation can be affected by additives, blowing agents, stabilizers, and the mixing ratio. By offering different types of test containers, the new Universal Foam Qualification System FOAMAT 285 combines versatility and high measuring accuracy. The FOAMAT 285 is the follow-up model of the well established Foam Qualification System FOAMAT 281. Among others, it has a significantly improved rise height and pressure measurement.

Rise Profile

The classic method of characterizing foams is to measure the rise height or rise profile. The expansion of a foam sample can be measured in a cup, a box, or a cylinder. The critical start time is evaluated from the rise rate. It indicates the start of the reaction between the reactive components after mixing. The rise time is another fundamental foam parameter. It is defined as the time between the start of mixing and the maximum expansion of the foam. The new ultrasonic fan sensor LR 4 (Figs. 1, 5, 7) is especially designed for measuring the distance to the foam bun with high accuracy. It features an

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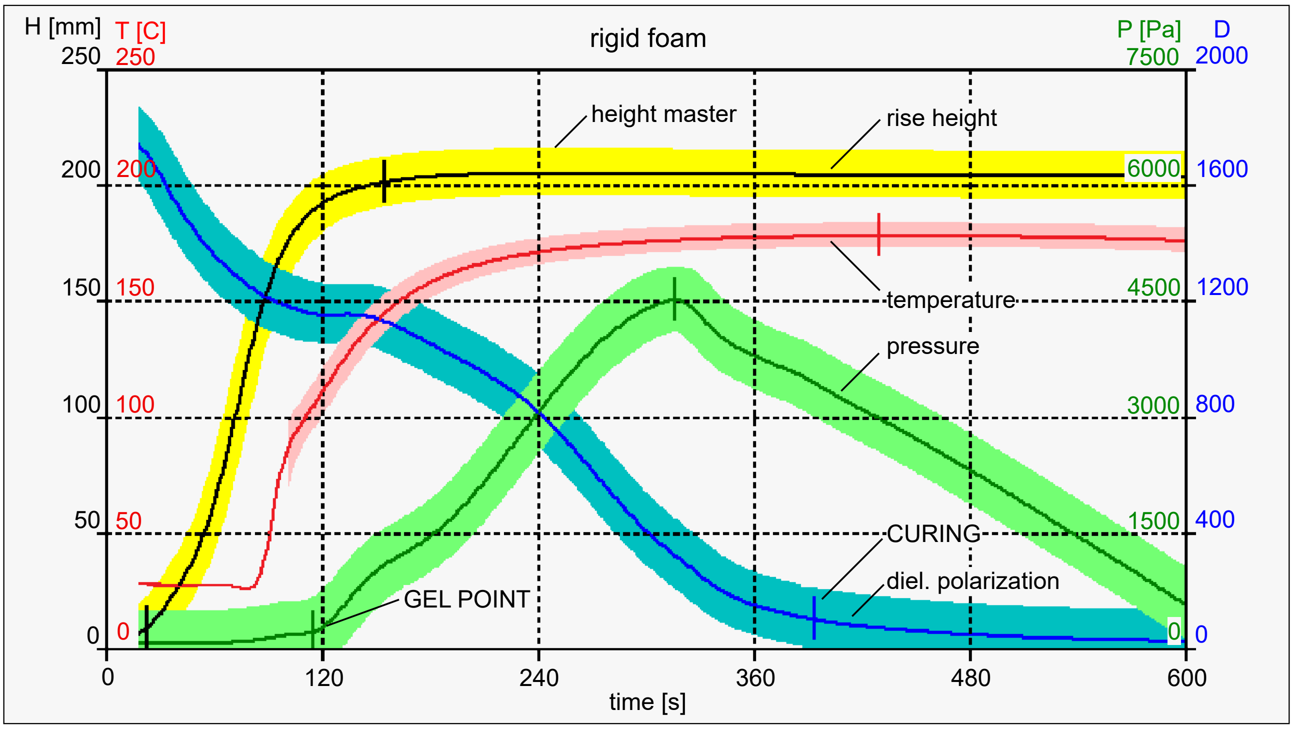

***Figure 2:** The curves show the reaction of a rigid foam measured by FOAMAT with FPM/CMD 150. Rise height (H), reaction temperature (T), rise pressure (P), and dielectric polarization (D) are recorded simultaneously by the software FOAM. The colored areas are master curves for QC.*

integrated fan for air homogenization, an ultrasonic transducer, and a temperature gauge for speed of sound compensation. All types of foam can be measured, including flexible molded and slabstock foams, semi-rigid foams, and rigid foams with strong heat release. The expansion containers can be heated to ensure equal starting conditions as well as to reach the required reaction temperature. In quality assurance testing, the rise profile, which is a fingerprint of the foam, is compared to its master curve. A master curve (Fig. 2) is a tolerance band showing the margins of a "good" foam sample. While rise height measurement still continues to be the standard method of foam testing, additional sensors of FOAMAT are available, revealing more details of the foam formation process.

Reaction Temperature

The compound formation and the cross-linking reaction cause an exothermal temperature increase in the foam sample. Thin thermocouples are ideal for measuring the temperature inside the foam as they have a low heat capacity and are easy to apply. They hardly interfere with the foam formation and can be used repeatedly. The maximum core temperature is measured by placing the thermocouple in the lower third of the foam.

Rise Pressure

Pressure builds up when the gelling reaction starts. Stable cell walls are formed which hinder further foam expansion. The remaining blowing agents are trapped and heated. The increasing gas pressure causes stress within the foam. High pressure forces are generated by rigid foams in the production of wall elements and insulation panels. They are stressed at right angles to the direction of foam flow. In cylindrical test containers the stress at the bottom of a rigid foam sample can reach high values. The resulting load is named the "rise pressure" as it depends on the total rise height. The rise pressure is measured with the patented **FPM** (**F**oam **P**ressure **M**easurement) device (Fig. 3), which is available with cylinder diameters of 50, 70, 100, 150 and 225mm. The stress of the expanding foam loads the bottom

***Figure 3:** The cardboard cylinder (right) with the cured foam sample can be removed from the **F**oam **P**ressure **M**easurement device **FPM 150**. The **CMD** (**C**uring **M**onitor **D**evice) sensor is mounted on top of the FPM 150 pressure plate (left). It enables the simultaneous measurement of the dielectric polarization and the rise pressure.*

FOAMAT®

of the cylinder, where the applied force is measured by a load cell. The expansion volume is confined by the walls of the cardboard cylinder and the FPM base plate. A thin foil protects the base plate against contamination. The FPM replaces normal test cups and boxes.
Whereas the rise curve reflects the blowing agent generation, the rise pressure mirrors the cell properties, which are affected by the polymerization reaction. Pressure measurement can yield valuable information about the effects of catalysts on gelling. Furthermore the rise pressure determines the blow off point of flexible foams and it can distinguish between open and closed cell formation. The pressure curve reveals the objective gel point. For production purposes, the pressure decrease indicates the demolding time. Since the foam can expand freely to the top while the pressure is being measured, FOAMAT is able to measure the rise profile simultaneously. FPM devices are available with different cardboard cylinder diameters. For high density foams or low extrusion rates the FPM 70 (Fig. 6) is recommended. Its expansion volume is confined by cardboard tubes of 70mm diameter. For low density foams and big foam samples the FPM 150 (Fig. 3) is preferred. The FPM 2 with 100mm cylinder diameter has all-round features and can be used for many types of foam. In order to simulate the production conditions in a mold, the FPM pressure plate can be heated with an electrical closed loop control.

Viscosity / Flowability

A particular advantage of measuring the pressure at the bottom of the cylindrical expansion container of FPM is that it allows to calculate the viscosity of the foam directly from the measurement data gained by FOAMAT. Hagen-Poisseuille's viscosity equation of a fluid in a tube is applied (Fig. 4). The model

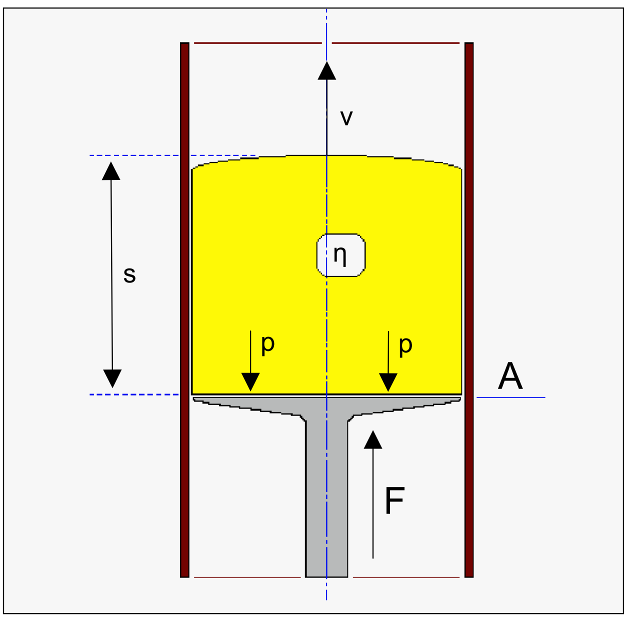

Figure 4: The physical model of Hagen-Poisseuille's viscosity equation is applied to the Foam Pressure Measurement device FPM.

Figure 5: *The loss of weight is measured by a laboratory balance integrated into the FOAMAT system. The foam residue remaining in the mixing cup is used for this purpose.*

defines the viscosity by the force, which is needed to move a section of foam through a tube with a given speed. In the FPM the cardboard cylinder resembles the tube and the force is calculated from the pressure reading. The pressure data gained by the FPM and the rise profile of FOAMAT are sufficient to calculate the viscosity vs. time curve. This algorithm is integrated into the FOAM software.

Dielectric Polarization

The dielectric polarization is a measurement parameter that gives insight into the electrochemical processes occurring during foam formation. Dielectric polarization is essentially caused by chain-like molecules with a large dipole moment due to their polar ends (OH, NCO groups for PU and PIR foams). Chain formation precedes the cross-linking reaction that ultimately suppresses all dipole mobility by curing. The dielectric polarization sensor **CMD** (**C**uring **M**onitor **D**evice) is located on the pressure plate of the FPM (Fig. 3). Due to the rise pressure, the foam is pressed onto the surface of the CMD. The dielectric polarization is measured as an increase in capacity relative to the empty container. The dielectric polarization shows the formation of intermediates like amine and the final curing of the foam by decreasing to a low and constant signal when the chemical reaction is completed. CMD is

***Figure 6:** Size comparison of two FOAMAT test containers: The **FPM 70** (left) is designed for rise height and pressure measurement of high density foam samples. The picture shows a sealing foam in a 70mm cardboard cylinder. The Advanced Test Container **ATC** (right) is heatable from the bottom to the top and has semi-cylindrical side walls. The lower part contains an FPM/CMD 150 device for pressure and polarization measurement. The insulated upper part can be lifted to ease the ejection of the cured foam sample.*

provided in combination with the pressure measurement device FPM.

Balance Integration

In order to obtain reproducible measurement data, the reaction components must be weighed exactly. Despite the utmost care on behalf of the user, remnants adhering to the stirrer and remaining in the mixing cup may lead to uncertainties in the tested foam mass. The integration of a laboratory balance into the FOAMAT system (Fig. 5) automatically records the mass of each component in the batch documentation. Additionally, the loss of weight due to the release of blowing agents and volatile components during foaming process, as well as due to the buoyancy can be recorded continuously. The mass of the residue left in the mixing cup can also be measured. Another advantage of the balance integration is the determination of the foam density from the mass of the finished foam sample and its final rise height. The new software FOAM also provides the calculation of the density curve and the specific volume curve from the rise height curve, the loss of weight curve, the test container geometry, and the mass of the finished foam sample.

Ambient Conditions

The room temperature, the relative humidity, and the air pressure are measured by the meteorological station GFTB (Fig. 7). All this meteorological data is stored with the other test data and displayed with the other measurement parameters.

Production Simulation

Disposable cups, boxes and cardboard cylinders are commonly used to measure the physical generation parameters of reactive foam formulations. These are typically non-temperature controlled test containers. In real production, however, molds and other foam surfaces are precisely thermostated. Undefined temperatures spoil the correlation

***Figure 7:** The **BFC 200** (**B**ox **F**oam **C**ontainer) is placed onto the base plate of the stand. A thermocouple is inserted into the foam using a special positioning holder. The ambient data is measured by the meteorological station **GFTB**.*

***Figure 8:** The **A**dvanced **T**est **C**ontainer **ATC XL** (center) has four times the test volume of the standard **ATC** (right). Each of them comprises an upper and a lower part, which are clamped by spring locks. The foam sample (left) can easily be ejected through the bottom opening of the upper part.*

between laboratory investigation and the production situation. This is critical especially for PIR and phenolic foams which only cure at elevated temperatures. The **A**dvanced **T**est **C**ontainer **ATC** and the larger version ATC XL (Fig. 8) overcome this problem by two temperature controlled closed loops for heating the bottom plate and the semi-cylindrical side walls. For measuring the foam formation parameters they comprise both, a Foam Pressure Measurement (FPM) and a Curing Monitor Device (CMD). Additionally the core temperature is measured with a thermocouple being inserted through the ATC wall. The ATC is reusable and replaces consumables like cups, cardboard cylinders, and paper boxes.

Easy Handling

Upon test completion, the ATC spring locks are released. The upper part of the ATC can be lifted and the foam sample is ejected by simply pushing it downward. As the inner surface of the ATC is covered with a release agent, the foam sample can be removed easily from the device.

Reliable Test Results

Due to consistent temperatures, the measurement results of ATC are more comparable to the production situation. The decrease of the dielectric polarization reveals information about the curing process. As expected, curing goes faster at higher temperatures and more foam volume is generated. The pressure data is very consistent when measured with ATC.

In combination with the new Foam Qualification System FOAMAT 285, the ATC is a versatile accessory for measuring foam parameters of all types of formulations under selectable temperature conditions. The pressure and the dielectric polarization data provide valuable information how additives influence the gelling and curing of the foam. Featuring consistent elevated temperatures, the ATC opens a new dimension in quality control and development of PU, PIR, EPOXY, silicone and phenolic foam formulations.

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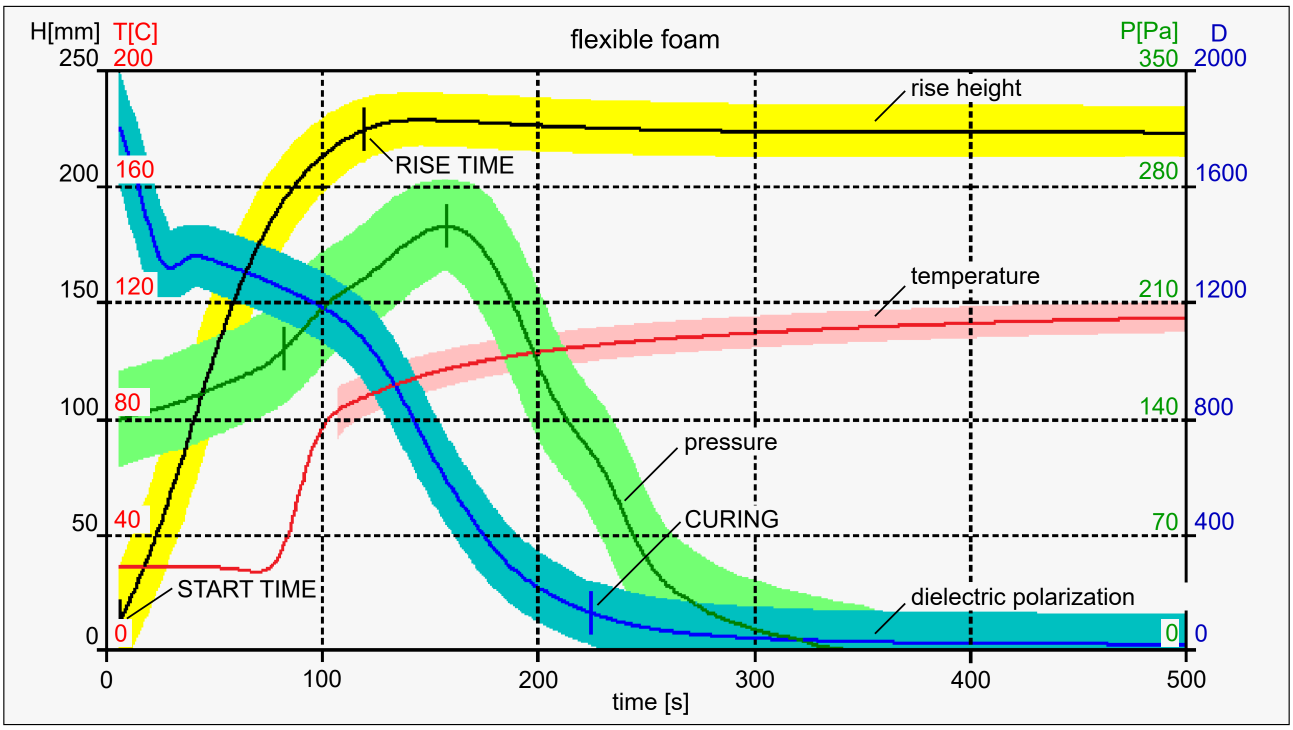

***Figure 9:** Rise profile (H), temperature (T), rise pressure (P), and dielectric polarization (D) curves of a flexible polyurethane (PU) foam. The start time and rise time are evaluated from the rise height data. The curing time is determined from the gradient of the dielectric polarization.*

***Figure 10:** The **O**ne **C**omponent **F**oam **M**easurement device **OCFM** has a special holder for aligning the **FPM 50** and the cardboard cylinder under the ultrasonic sensor. The **P**erfect **P**reparation **A**id **PPA** (right) helps to inject a defined amount of froth.*

One Component Foam Measurement (OCFM)

- **Rise profile in a narrow cardboard cylinder**
- **Reaction temperature**
- **Foam Pressure Measurement FPM 50**
- **Cylinder alignment by innovative holder**
- **Accessory to the FOAMAT® 285 system**

patent pending

One Component Foam Measurement

The **O**ne **C**omponent **F**oam **M**easurement device **OCFM** (Fig. 10) is specially designed to measure the rise profile, the rise pressure, and the reaction temperature of One Component Foams (OCF). The OCFM comprises a narrow cardboard cylinder and a special holder for aligning the cardboard cylinder under an ultrasonic distance sensor. The foam is confined by the walls of the cardboard cylinder, the pressure plate of the foam pressure measurement device at the bottom and a movable plug on top (Fig. 12).

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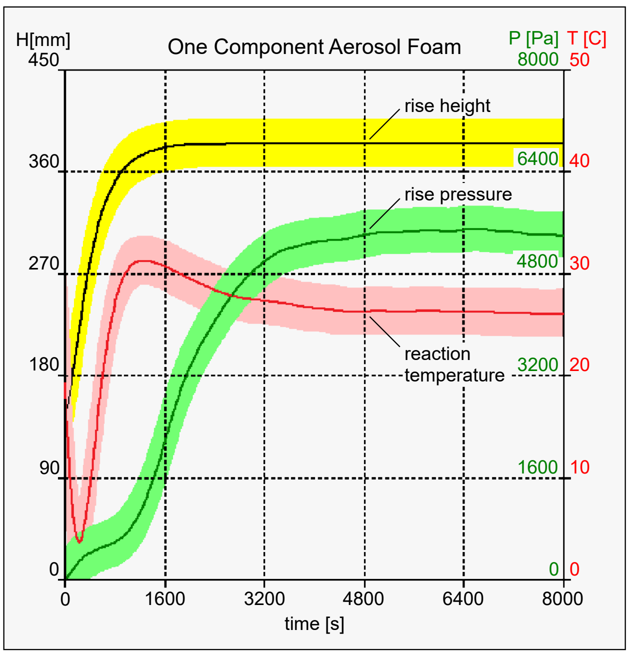

***Figure 11:** The curves show the reaction of a **O**ne **C**omponent **F**oam (**OCF**) measured with **OCFM** and FOAMAT. The rise height (H), the rise pressure (P), and the reaction temperature (T) are recorded simultaneously.*

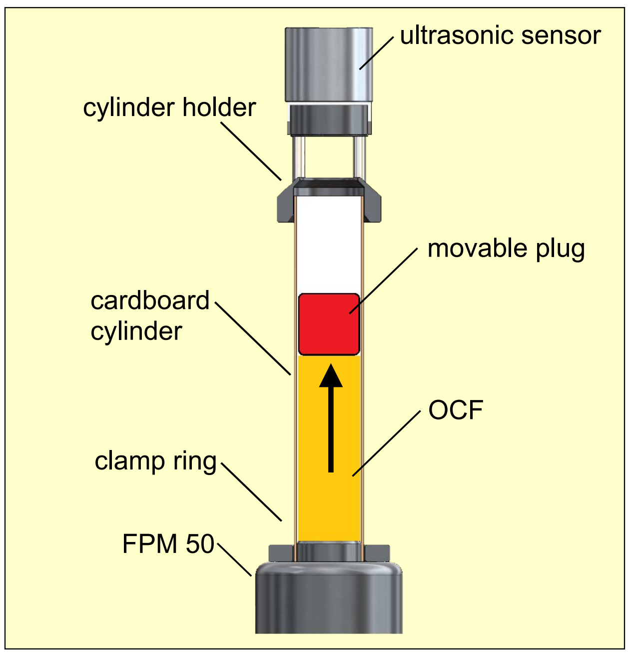

***Figure 12:** Cross section of the **OCFM** device. The OCF is filled into the narrow cardboard cylinder which is clamped onto the pressure measurement device **FPM 50**. The movable plug confines the expanding foam to the top.*

Figure 13: *The Test device **SubCASE HT** can measure the pot life and the curing of reactive plastics. It is designed for high reaction temperatures. The core temperature is measured by a reusable thermocouple inserted vertically into the center of the plastic sample.*

SubCASE®

Pot Life and Curing Monitor for Reactive

- **C**oatings
- **A**dhesives
- **S**ealants
- **E**lastomers

based on

- **PU formulations**
- **EP, UP, and MMA resins**

Patent No. 102004001725

Pot Life Monitor

SubCASE is a laboratory device for measuring the pot life and the curing behaviour of **C**oatings, **A**dhesives, **S**ealants and **E**lastomers (**C.A.S.E.**). The measurement device is especially designed for testing polyurethane, epoxy and polyester formulations. The compact mechanical design of SubCASE combines dielectric polarization measurement by using a **CMD**-sensor (**C**uring **M**onitor **D**evice) and temperature measurement by a thermocouple and a PT transducer.

CMD-Sensor

The dielectric polarization is the key value in measuring chain formation and cross-linking of reactive plastics. It reveals the reaction profile of the entire chemical process starting off with the reactive mixture and finally ending with a cured compound. The CMD-sensor consists of two comb-shaped electrodes forming a plane capacitor. It is mounted onto the heated base plate of SubCASE and is protected by a foil, which avoids any direct contact between the reactive material and the sensor. The dielectric polarization and surface temperature data is obtained from the very beginning of the chemical reaction. Additionally the core temperature in the center of the test sample is measured by means of a vertically inserted thermocouple (TC, Figs. 13, 14, 17). Testing under production near conditions is accomplished by temperature controlling the CMD-sensor to any production relevant temperature. Three SubCASE versions are available, the SubCASE 110°C (Fig. 16) with a maximum heater temperature of 110°C, the SubCASE HT (Fig. 13) with a maximum heater temperature of 150°C, and the SubCASE LT (Fig. 17), which needs to be connected to a circulating water bath for heating and cooling. The core temperature of the chemistry can exceed the maximum heater temperature. The sensor material of the CMD-sensor is designed for these core temperatures. The user-friendly software SUBCASE controls the measurement cycle. It acquires, evaluates and displays the measurement data (Figs. 15, 18, 19).

Test Cycle

Before starting a new test cycle a protection foil is rubbed onto the CMD-sensor using an adhesion promoting agent. A new cardboard cylinder, which forms the test container is fastened with the clamp mechanism. The mixing time, the test time, and the heater temperature are free selectable parameters in the software SUBCASE.

The reactive mixture can automatically trigger the data acquisition when poured into the test container. After completion of a test, physical values like pot life and curing are evaluated from the measured curves and are listed together with other input data in a parameter list. The pot life is defined as a percentage value of the maximum dielectric polarization. The curing is determined from the dielectric polarization gradient.

When a test is finished, the cardboard cylinder containing the cured sample is pulled off the CMD-sensor. The protection foil sticking to the sample is also removed. The thermocouple can be pulled out of the disposable glass tube and can therefore be reused for further tests.

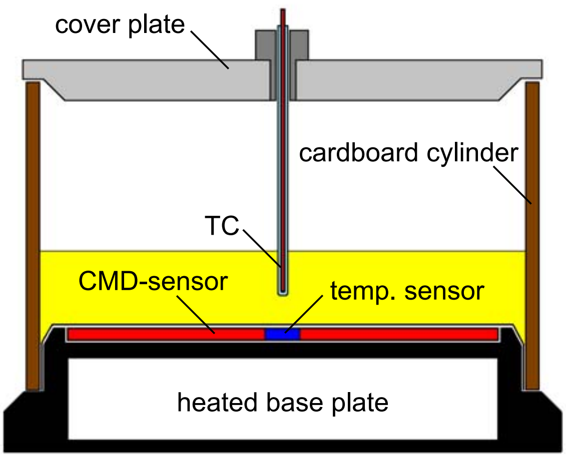

Figure 14: *Cross section of the* ***SubCASE*** *test container. The CMD-sensor is mounted onto the temperature controlled base plate and is covered with a protection foil. The core temperature is measured by a thermocouple, which is inserted vertically through the cover plate.*

Technical Data	**SubCASE**
Pot Life Monitor	
measurement rate	10 Hz
serial interface	RS 232 C, USB
dimensions	270x205x180 mm
test cup diameter	100 mm
mass	app. 4 kg
CMD-Sensor	
diameter	90 mm
polarization frequency	10 … 1000 Hz
Temperature Control	
SubCASE 110°C	20 … **110** +/- 0.5°C
SubCASE HT	20 … **150** +/- 0.5°C
SubCASE LT	5 … 90 °C
Temperature Probe	
thermocouple	Type K (NiCr/Ni)
range	0 … 300°C
External Power Supply	
SubCASE 110°C + LT	12 VDC, 5.5 A
SubCASE HT	24 VDC, 4.0 A
Order No.	
SubCASE 110°C	**300120**
SubCASE HT	**300130**
SubCASE LT	**300140**

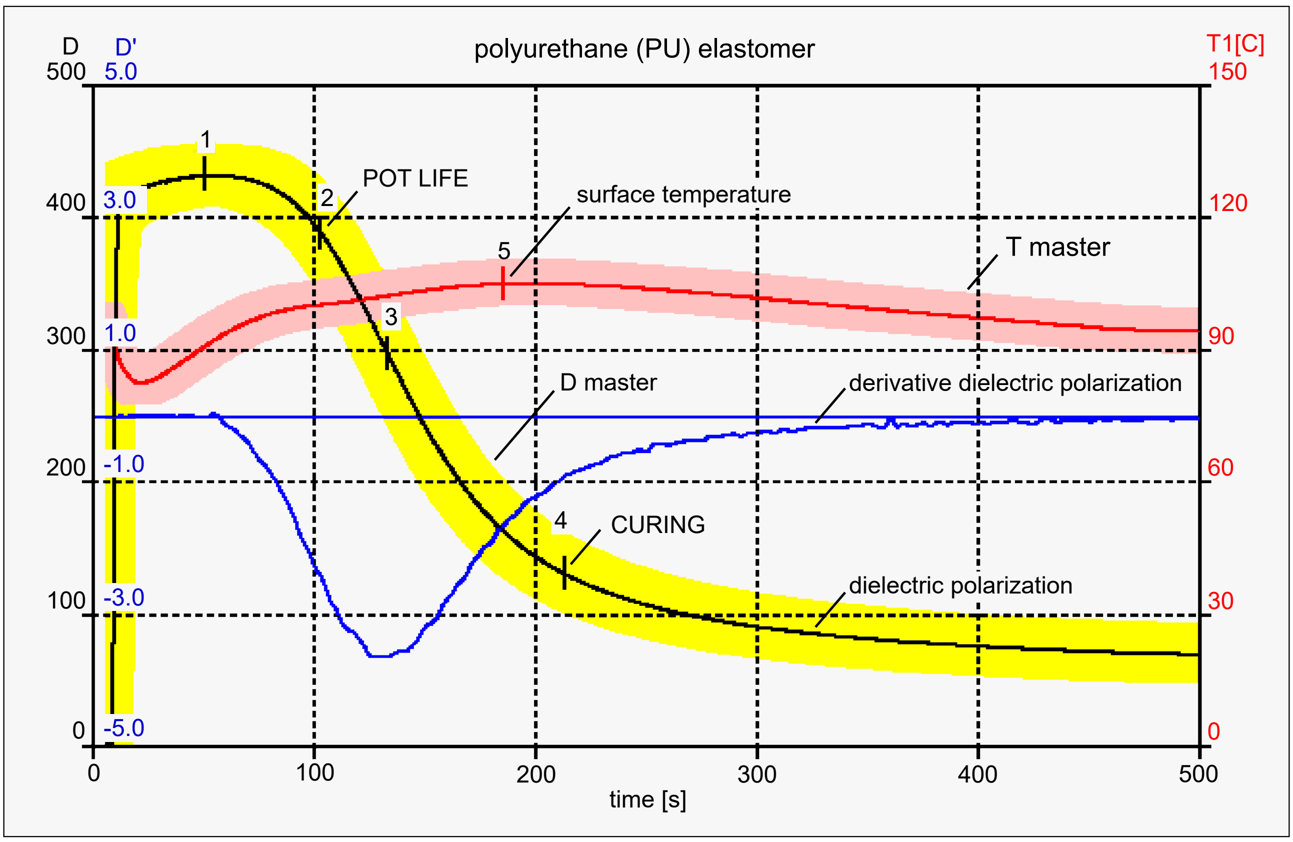

Figure 15: *The curves show the dielectric polarization (D) and the surface temperature (T1) of a polyurethane (PU) elastomer. The D master and the T master are margins for quality control purpose. The pot life and the curing are evaluated from the dielectric polarization curve and its derivative (D').*

__Figure 16:__ The test device __SubCASE 110°C__ is designed for measuring the pot life and the curing of Coatings, Adhesives, Sealants and Elastomers.

__Figure 17:__ The __SubCASE LT__ for testing at low and constant temperatures. A temperature controlled circulating water bath is connected to the base plate.

SubCASE®

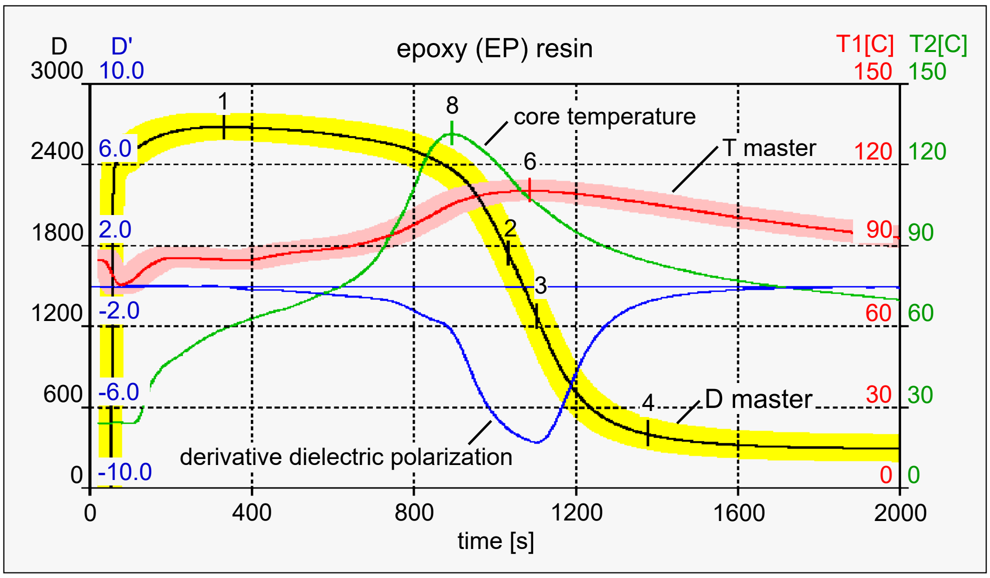

__Figure 18:__ Reaction profile of an epoxy (EP) resin measured with SubCASE HT. The core temperature (T2) is detected by a thermocouple centered in the test sample. The curves are examples and they may differ for other formulations.

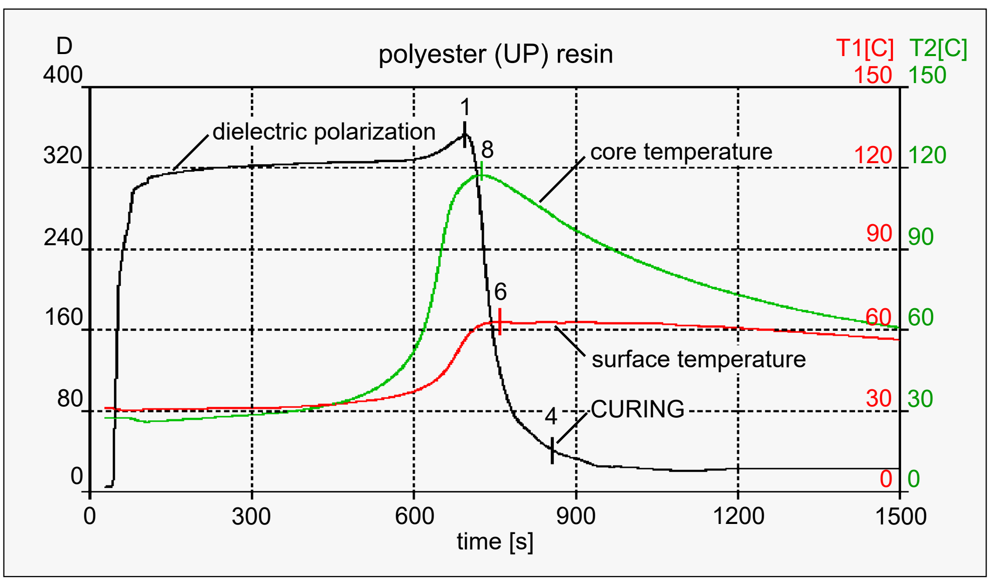

__Figure 19:__ The dielectric polarization D, the surface temperature (T1), and the core temperature (T2) of an unsaturated polyester (UP) resin measured with SubCASE HT.

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***Figure 20: Resimat 150** is designed for the measurement of the recovery time of viscoelastic foams according to the IKEA® specification IOS-MAT-0076. The cubic test sample (red) has an edge length of 150 mm.*

Resimat®

Recovery Measurement of Viscoelastic Foams

- **Meets IKEA® specification IOS-MAT-0076**
- **Pressure relaxation during compression**
- **Adjustable strain by mechanical alignment**
- **Viscoelastic appearance calculation**
- **Two mechanical setups for different sample size**

Patent No. 10252211

Visco-Elasticity

Viscoelastic foams show a characteristic creep behavior when loaded by an external force, e.g. the weight of a body. This makes them comfortable when being used in bedding and seating applications. Resimat 100 and 150 (Fig. 21 and 20) are devices specially designed for testing the dimensional recovery properties and the pressure relaxation of viscoelastic foams. If a Resimat 150 is used, the recovery time according to IKEA® specification no. IOS-MAT-0076 can automatically be detected by the WINDOWS based software RESIMAT. The device can be used for development as well as for quality assurance testing of viscoelastic foams.

Measurement Cycle

A test sample with the dimensions 100x100x50 mm³ (Resimat 100) or 150x150x150 mm³ (Resimat 150) is compressed vertically by means of a pressure plate (Fig. 22) onto an adjustable reference surface. At a certain compression clamps fix the pressure plate and keep the strain for a pre-selected hold time. The software RESIMAT supports this procedure.

While being compressed a force gauge measures the restoring force of the foam sample. Due to its viscous properties the force gradually decreases revealing the comfort parameters of the foam. After the hold time the clamps instantly release the pressure plate. The sample gradually recovers from the deformation regaining its original shape. An ultrasonic sensor positioned right above the pressure plate continuously records the kinetics of the sample surface. The thickness vs. time curve (Figs. 23, 24) shows the recovery process giving further insight into the dynamical features of the foam.

Test Results

The position of the reference surface and the original thickness of the unstrained foam sample are both measured in a zero measurement. This data determines the final sample strain. The hold time and the time the recovery process is measured are free selectable parameters. For tests according to IOS-MAT-0076 a strain of 75% and a hold time of 60 seconds is specified.

After compression and subsequent recovery, the time dependent data is displayed graphically. The recovery time according to IOS-MAT-0076 is detected when 90% of the original thickness is reached. The viscoelastic appearance is the area between the recovery curve and the original sample thickness. The recovery time, the appearance and other test parameters evaluated from the curves are listed in a parameter list together with the input data.

Figure 21: *Mechanical setup of* ***Resimat 100*** *of the product generation 287 for measuring viscoelastic foam samples with typical dimensions of 100x100x50mm³.*

Technical Data Resimat

Controller Unit	
measurement rate	50 Hz
serial interface	USB
electrical data	25 W, 100 ... 250 VAC
dimensions, mass	330x270x160 mm; 4.4kg
Mechanics / Sensors	
max. force	500 N
force resolution	0.01 N
clamp force	
Resimat 100	2 x 300 N
Resimat 150	4 x 300 N
distance sensor	LR 4, ultrasonic
resolution	0.1 mm
dimension	360x240x570 mm,
mass	
Resimat 100	10 kg
Resimat 150	14 kg
Test Sample	
cross section	
Resimat 100	100x100 mm²
Resimat 150	150x150 mm²
thickness	25 … 150 mm
max. compression	10:1
Order No.	
Resimat 150	287110
Resimat 100	287100

Resimat®

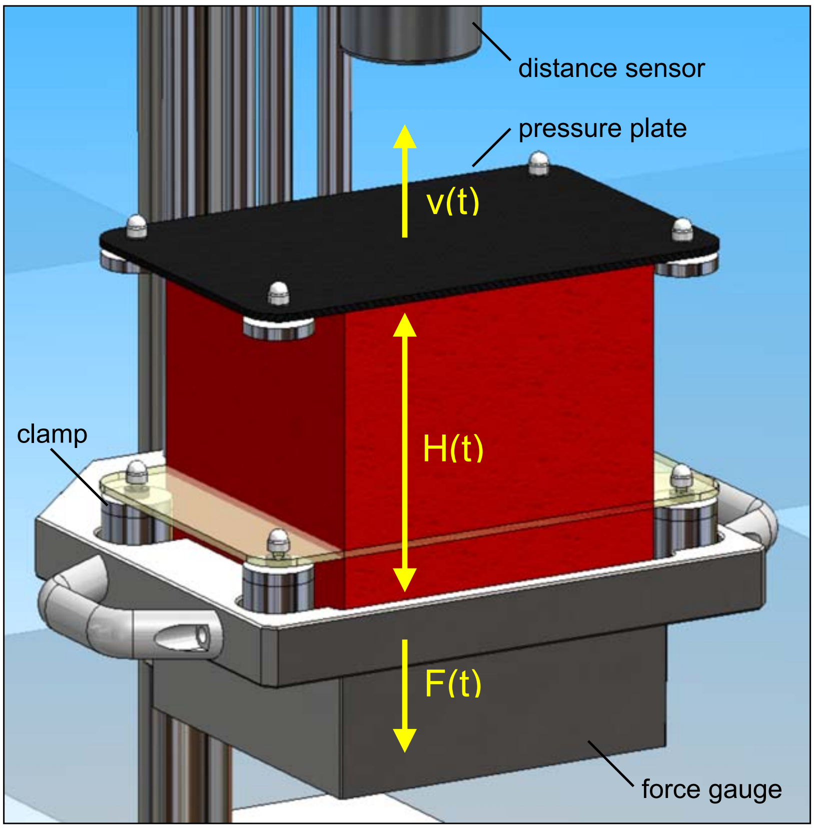

Figure 22: *Schematic view of the* ***Resimat 150*** *device. The foam sample is compressed by the pressure plate. The force gauge reads the restoring force (F) during the hold time. The ultrasonic sensor measures the time dependent thickness (H) of the sample after releasing the pressure plate.*

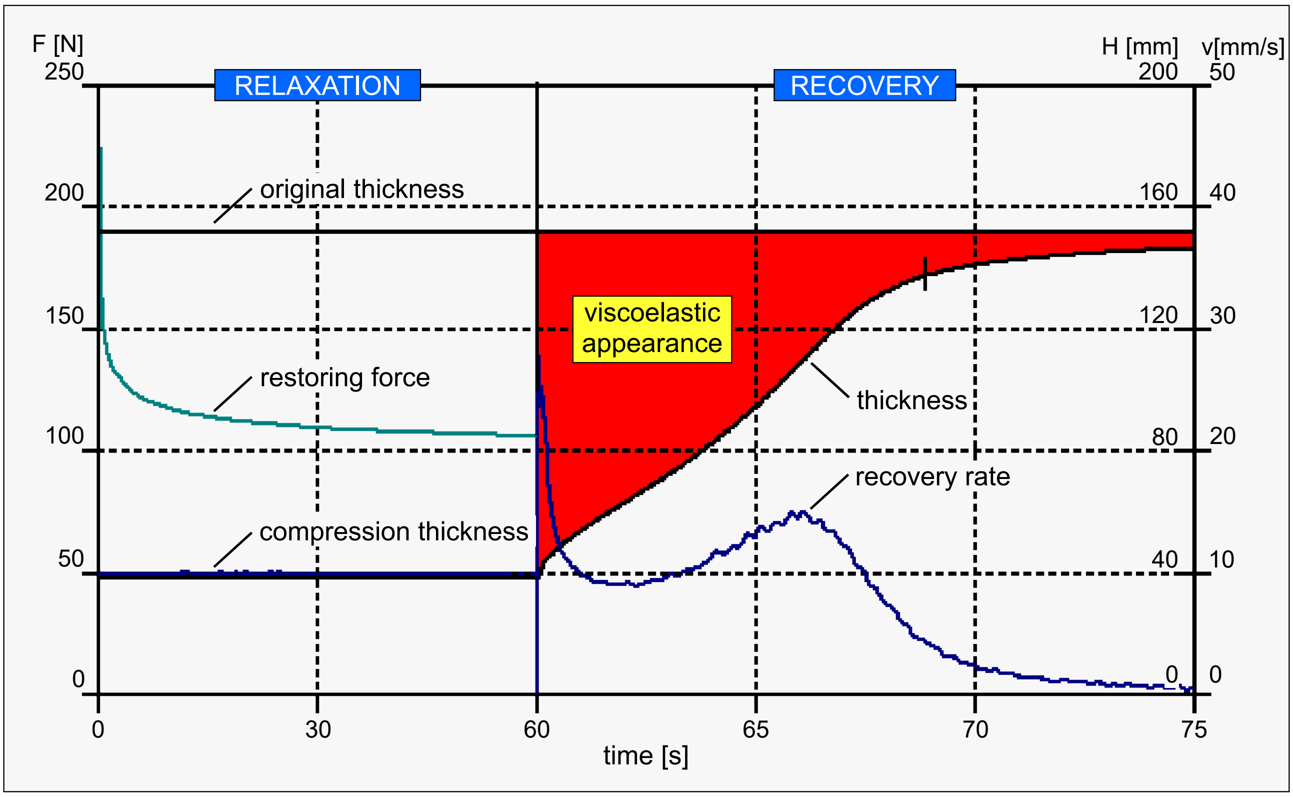

Figure 23: *The restoring force (F) shows the relaxation during the hold time. The thickness (H) vs. time curve shows the free recovery after releasing the pressure plate. The recovery rate (v) is the gradient of the thickness curve. The red area shows the "appearance".*

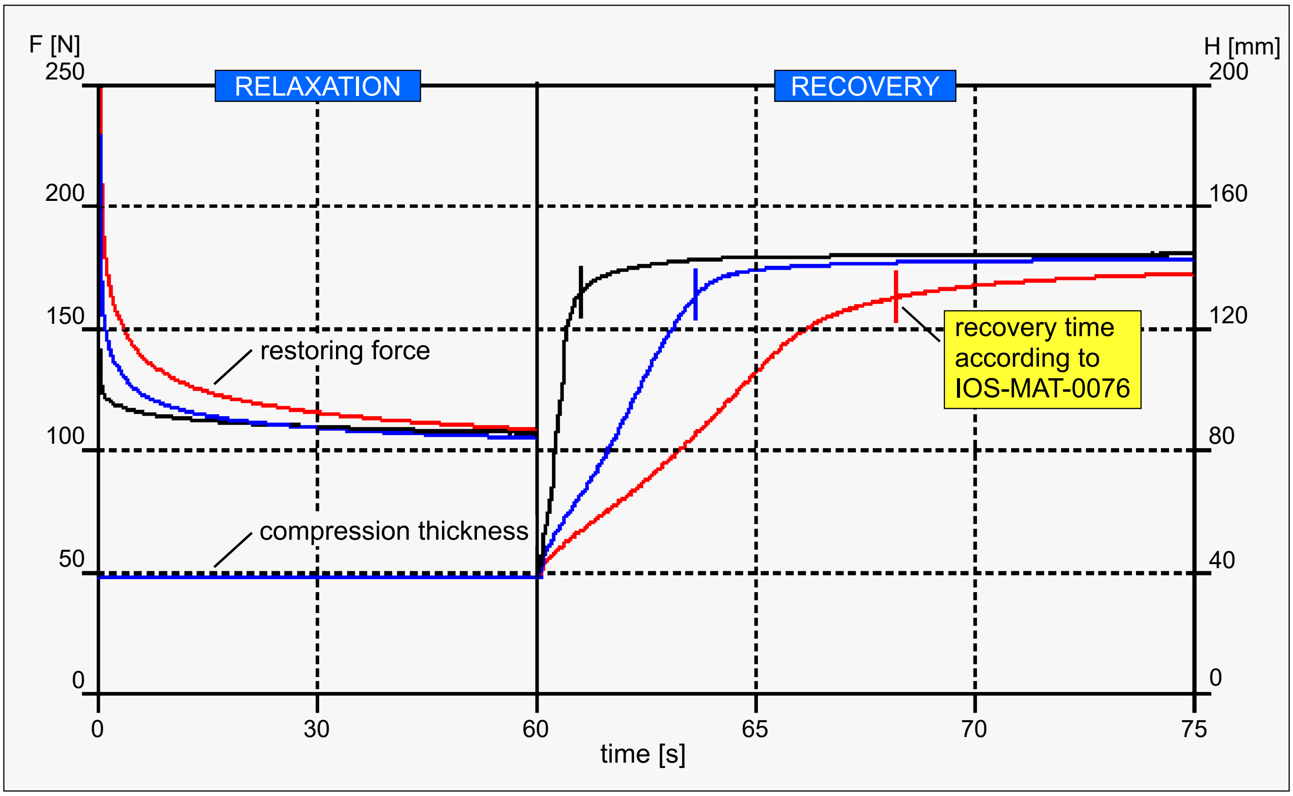

Figure 24: *Graphical overlay of three Resimat® 150 measurements of different foam samples. The recovery time according to IOS-MAT-0076, is the time needed to regain 90% of the original shape after a 75% compression for 60 seconds.*

Figure 25: The Controller Unit ***SONIC JOKER*** *and the two ultrasonic Fan-Sensors* ***FS 2*** *are mounted for the thickness measurement of open celled foams, lying on a reference surface.*

SONIC JOKER®

Precision Ultrasonic Sensor for Distance and Thickness Measurement

- Maximum range 2500 mm
- Accuracy 0.1mm
- Self-calibration by reference bar
- Integrated fan for air homogenization

Patent Nos. 3621819, 59005295

Distance and Thickness

SONIC JOKER is a high resolution ultrasonic measurement device designed for precise distance measurement in quality control and continuous production. Almost any solid object or liquid level can be measured with high accuracy, despite of its color and surface structure. Due to the high intensity of the ultrasonic pulses, even highly sound absorbing materials like foams, textiles and insulation mats can be measured. A standard application is the thickness measurement of products made of foam, plastic, rubber, and stones in the production process. Fill levels of liquids, pastes and granulates can also be recorded. Process control is assisted by special I/O functions. One serial output and two analogue outputs are available for data transfer. Two sensor heads are connected to one controller unit for comprehensive survey and redundancy (Figs. 27 and 28). Free hanging foils in continuous production are measured with an anti-parallel sensor alignment.

High Accuracy

The ultrasonic distance measurement is carried out according to the pulse/echo method. The distance between the sensor head and the reflecting object is calculated from the traveling time of the sound pulses from the sensor to the object and their echoes. The knowledge of the sound propagation conditions, i.e. the velocity of sound, is essential for a high accuracy measurement. This is achieved by the patented sensor heads FS 1 and FS 2 of SONIC JOKER: A built-in reference bar gives continuous calibration signals and compensates for temperature changes and different air composition (Fig. 26). The integrated ventilation fan homogenizes the air volume between the sensor head and the object, thus giving definite and unspoilt sound propagation conditions for high accuracy measurements.

SONIC TOOLS

The measurement data is transmitted continuously to a PC. The software SONIC TOOLS (Fig. 29) comprises subroutines for setting SONIC JOKER parameters and continuous production survey with limit control.

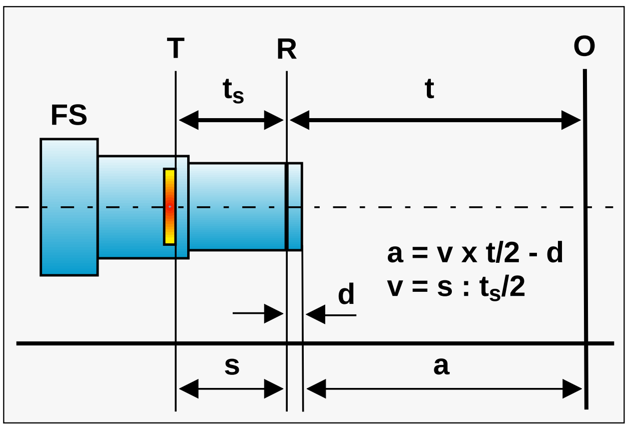

Figure 26: *Measurement principle of SONIC JOKER: The propagation time* ***t*** *and the velocity of sound* ***v*** *determine the distance* ***a*** *of the object* ***O****.*
T: *ultrasonic converter* ***R:*** *reference bar*
s: *reference distance* ***d:*** *position of the nozzle*

Sonic Joker®

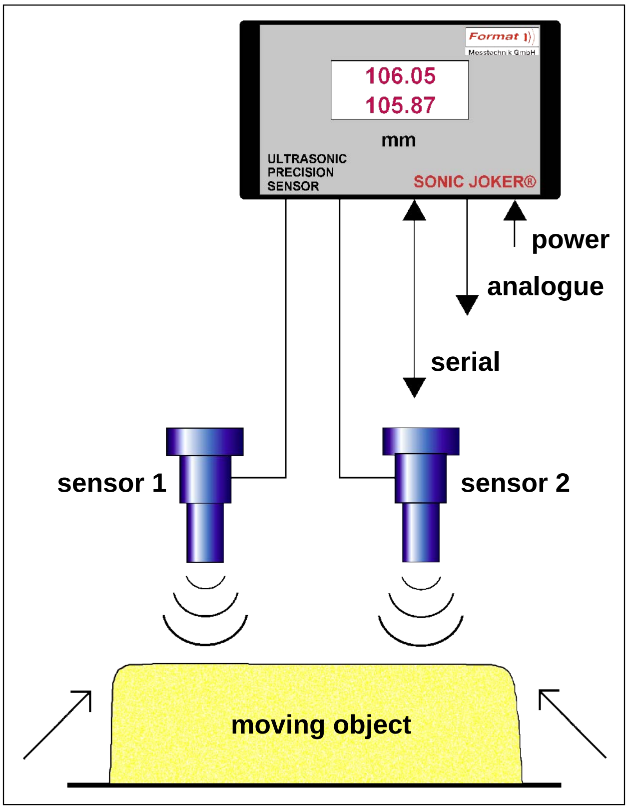

Figure 27: SONIC JOKER with controller unit and two sensor heads for parallel thickness measurement of a moving object using a reference surface.

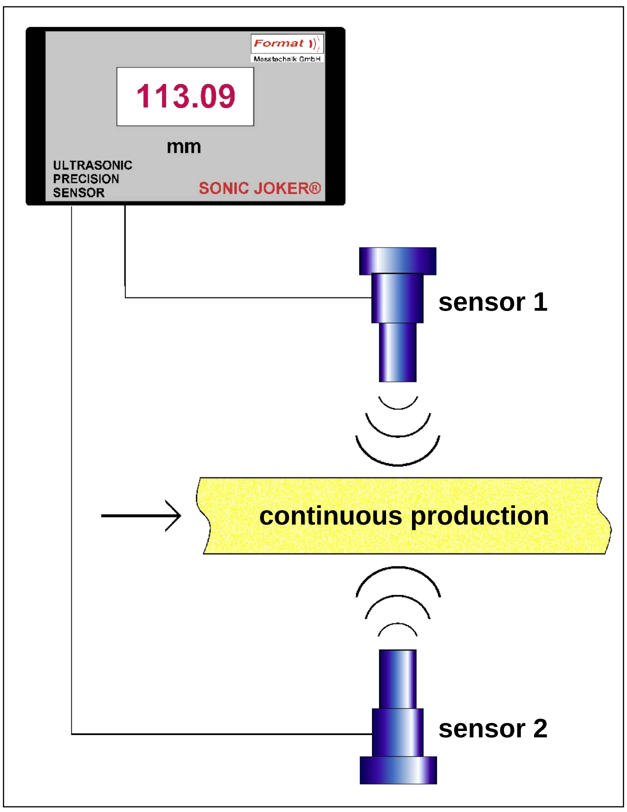

Figure 28: SONIC JOKER with controller unit and two sensor heads aligned anti-parallel for the direct thickness measurement without support.

Technical Data

Controller Unit

supply voltage	10...30 V DC
power consumption	15 VA
weight	2 kg
dimensions (l x w x h)	220 x 120 x 95 mm³
distance range	
FS 1	30 … 2500 mm
FS 2	30 … 120 mm
resolution	10 µm
accuracy *	0.1 mm
measurement rate	200 / s max.
serial interface	RS 232C
analogue output	0-10V (4-20mA)
protective class	IP54

Sensor Head

converter diameter	40 mm
dimensions	
FS 1	183 mm x ø 94 mm
FS 2	230 mm x ø 94 mm
weight	
FS 1	625 g
FS 2	725 g
beam divergence	+/-6°
protective class	IP30

* in homogeneous air

PC-Software SONIC TOOLS

- control of parameters and operational modes
- visualization of measurement data
- production control

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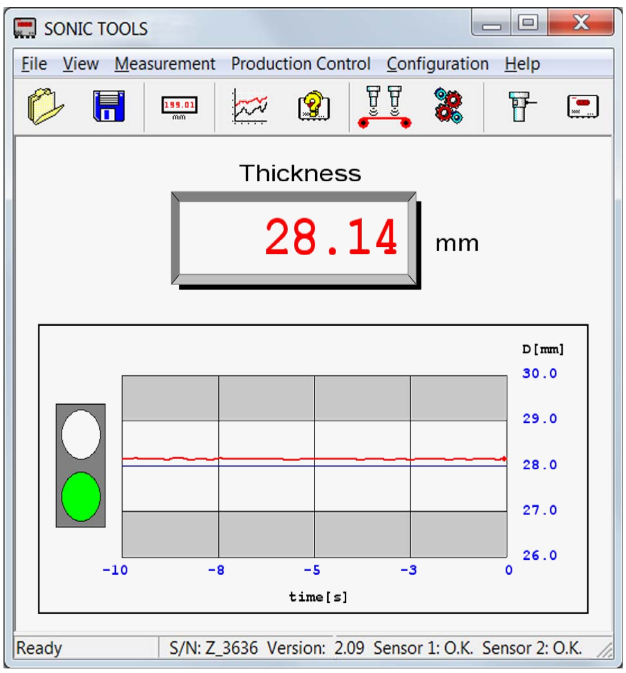

*Figure 29: The PC software **SONIC TOOLS** has a **production control** mode for continuous thickness measurement within defined limits.*

Sonic Joker®

Format ®

Messtechnik GmbH

know your foam !

Format Messtechnik GmbH
Im Schlehert 26
D-76187 Karlsruhe
Germany

Phone: +49 721 5311842
Fax: +49 721 5311844
E-mail: info@format-messtechnik.de
Internet: www.format-messtechnik.de

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